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ABSTRACT

Recalling several recent catastrophic examples of unethical behavior among engineers, this paper examines some of the obvious and non-obvious consequences of academic dishonesty as it occurs in engineering courses. The results of several studies relating to the extent of cheating in engineering courses, as well as the reasons for cheating are presented. Instructor complacency, pressure to win, and student ignorance are reported to be the main reasons why cheating is widespread and increasing. The consequences of cheating are discussed in terms of harm done to the cheater, noncheating students, instructors, the engineering profession, and society in general. Cheating is shown to put cheaters at an advantage when it comes to grades, admission to graduate school, application for scholarships, and job seeking. The performance of cheaters on the job is discussed, and the problems that occur when the company discovers that the engineer's job performance is far below what had been anticipated. This can hinder the efforts of colleges in placing students with companies that have had negative job performances from previous graduates of that institution. Specific suggestions to combat and prevent cheating in college engineering courses are included. (TW)

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# Cheating Among Engineering Students: An Analysis

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BY

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An Analysis

ABSTRACT

This paper discusses the obvious and non-obvious consequences of academic dishonesty as it occurs in engineering courses. The consequences are discussed in terms of harm done to the cheater, noncheating students, instructors, the engineering profession, and society in general. Specific suggestions are made for how to curb cheating as well. While this paper pertains specifically to engineering curricula, the implications are the same for other technical and scientific disciplines as well.

Cheating Among Engineering Students:

An Analysis

In recent decades, our society has become increasingly dependent upon engineers. As our society becomes more technologically complex, engineers will be called upon to make decisions of even greater importance to society. Recent events, however, cast serious doubt upon the capability of some engineers to make appropriate ethical decisions in their work.

There are several recent and catastrophic examples of unethical behavior among some engineers. Included among these is the decision of Ford Motor Company to market the Pinto automobile, even though testimony indicates that at least one high-ranking engineer considered the design unsafe.[1] Another example concerns the B. F. Goodrich contract to develop a 4-rotor brake.[2] Upon testing, the brake failed to meet specifications. Regardless of contradictory test data, the engineers involved were instructed to draft a positive qualification report. In order to do this, the engineers used falsified data. One of the engineers consulted an attorney and was advised to inform the FBI, eventually exposing the fraud, but only after—not before—his complicity in the fraud.

A third example of unethical behavior is related to the recent collapse of a Kansas City hotel walkway which killed and injured many people. It was subsequently discovered that the public inspectors were routinely falsifying investigation forms without having investigated the construction sites.[3] One last example concerns the 1974 Paris crash of a DC-10 airplane.[4] One engineer thought that the cargo door and passenger supports should be redesigned, yet his supervisor decided against modifications, for fear that their firm would have to pay for the redesign costs. Although they now know that should have been the proper course of

action, they both admitted at the time that it posed "an interesting legal and moral problem."[5] Apparently, then, not interesting enough.

Of course, only a small percentage of engineers engage in such behavior, and even those that do are seldom responsible for consequences as serious as those described above. Nonetheless, even a few such occurrences are serious enough to make us consider how to better train engineers to avoid these situations.

## The Extent of Cheating

To begin with, one might examine the extent and quality of ethics instruction received by most engineering students. Two observations are pertinent--the first obvious, the second not so obvious. First, one notes that there are few, if any, courses in engineering ethics offered in most engineering programs. Second, and perhaps more problematic, is the inadequate action taken by most engineering faculty and departments to prevent or respond to academic dishonesty. Academic dishonesty is a serious problem, because if students learn to cheat with impunity in the classroom, they might continue to cheat when gainfully employed.

Not attending to academic dishonesty would be less of a problem if it were not for the fact that cheating is widespread,[6] increasing,[7] and considered by many students to be a perfectly acceptable way to get ahead.[8] Engineering departments are not immune to this problem. The findings of two recent studies indicate that cheating occurs frequently in engineering courses. The first, conducted by the Arizona State University College of Engineering and Applied Sciences, found the 56 percent of the 364 students polled had cheated.[9] Subsequent research by Sisson and Todd-Mancillas found that as much as 56 percent of an entire graduating class of engineers

(287 students) ignored explicit instructions not to collaborate on graded work.[10]

## Reasons For Cheating

Instructor complacency, pressure to win, and student ignorance appear to be the main reasons why cheating is widespread and increasing.[11] Also, some research has been done helping us to better understand how cheaters justify their behavior.[12] Dienstbier's findings lead him to conclude, as have Barnet and Dalton,[13]that students are most likely to cheat when they feel subjected to intense and seemingly unjustified pressure. Dienstbier further concludes that eventually cheaters learn to perceive their academic dishonesty not as morally unjustified or even as questionable, but rather as a necessary and rational way of coping with the pressure to get good grades. Having developed a perspective justifying and promoting academic dishonesty, it is probable that the cheater goes on to apply this self-serving perspective to a variety of other circumstances, which, like stressful academic environments, pose no assurance of success, yet great pressure to succeed.

Thus, upon graduation, and finding oneself in the midst of a highly competitive work environment, an engineer (one who formerly developed the ability to rationalize academically dishonest behaviors) may cheat on the job as well. This cheating may be manifested in defrauding documents, such as those forged by B. F. Goodrich engineers discussed earlier. Just as students cheat in school as a means of coping with academic pressure, these engineers cheated as a means of coping with the professional demands of the marketplace. Regretfully, these engineers will now have to suffer the long-term psychic and financial cost of their involvement in the fraud, including difficulty in finding employment.

## Effects on Other Students

There is, then, reason to be concerned about the long-range consequences of cheating for cheaters themselves. But what of the consequences to other students? The non-cheating student suffers at least as much as the cheating student does. Statistically, even a small percentage of cheating students will create distorted grades, putting an honest student at a severe disadvantage. Furthermore, this distortion is exacerbated in engineering courses where partial credit and curving are common grading procedures. For instance, by merely glancing at another's paper, a dishonest student may learn how to set up a problem. Later, that student may claim, "At least I set up the problem correctly, and that should be worth at least 60 percent."

Academic dishonesty is, of course, not limited to cheating on tests. Some students cheat on written homework assignments by collaborating or copying, even when receiving prior and explicit instructions not to do so.[14] Students collaborating despite instructions forbidding it and the large grading emphasis placed on homework contribute to a potentially unfair scenario as follows: As a result of cheating, a student receives perfect grades on homework, yet receives poor test grades. However, when the final grade is computed, this student receives the same grade as all other students, indicating the same overall competence as the student who may have passed the test, but who received less satisfactory (but honest) homework grades.

Consider another less obvious consequence of cheating. Grades are often a function of the amount of time spent studying the material. A student with access to previous homework solutions, who knows the questions

that will be on the exam, or who has a friend who will help during the test, significantly decreases the amount of study time required to receive a good grade. This affords the dishonest student more time to study for other courses. The honest student, however, is not allowed additional study time and is therefore put at a disadvantage in the other courses as well.

Thus, it is clear that dishonesty in the classroom puts honest students at a disadvantage, at least insofar as achieving high grades is concerned. But this is not the only damage done to honest students. Two other consequences are even more serious. First, the dishonest student has an unfair advantage when applying for scholarships and admission to graduate school. Second, dishonest students obtain an unfair advantage when seeking employment, as employers prefer to hire applicants with better academic records. In the latter instance, the consequences to the larger engineering community may be far more serious than is an inequitable distribution of scholarhsip money or admission to graduate school.

Presume, for instance, that a company hires an engineering graduate of University X who had dishonestly obtained a high G.P.A. Subsequently, the company discovers that the engineer's job performance is far below what had been anticipated, given the engineer's impressive undergraduate record. In the future, that company may be less likely to rely on the academic records of other students graduating from Univeristy X. Perhaps the company's experience with this particular engineer will be so disappointing that they will recruit from other universities in the future. A similar predicament may occur when a student is admitted to graduate school on the basis of a dishonestly obtained (inflated) G.P.A. Conceivably, the student might be

unable to perform at the level of competence expected of them, resulting in failure to complete the program. Disappointment in this student's performance may cause this graduate program to excercise greater caution when selecting future applicants from University X. This would be unfair to future applicants whose competencies may be very real, but whose grade point averages are lower than the one obtained dishonestly by the previously admitted student.

## Effects on Instructors

Despite the serious nature of the above possible consequences of academic dishonesty, too few instructors implement measures for prevention, controlling, or detecting the problem. Reasons for this may be attributed to a lack of departmental or university support in prosecuting offenders,[15] the attitude that teachers ought not act as police officers,[16] and unawareness of either the high frequency of cheating or its serious short- and long-term consequences.[17] In addition, all of us have heard, perhaps even internalized the old adage, "Cheaters only hurt themselves." We have already discussed several harms of cheating affecting the cheaters' peers at least as much as the cheaters themselves. It is also the case that cheaters hurt their instructors as well. Two examples follow.

First, an engineer's unsatisfactory performance in the field reflects poorly on his or her former instructors. An instructor may be unable to leave one university for another because of the negative reputation associated with that instructor's graduates. Second, when students graduate, they become peers of their instructors. If instructors allow cheating, they degrade their own profession by admitting colleagues whose credentials were dishonestly obtained.

## Recommendations and Conclusions

From the above discussion we can conclude that cheating adversely affects all members of the academic community, including the cheaters themselves, other students, instructors, the university, the engineering profession, and society at large. Cheating must be curbed, and it is the instructor who is in the best position to do so. Many steps can be taken to combat cheating. Prevention is preferable. As recently delineated by Todd-Mancillas and Sisson, the following are among some of the more commonly offered suggestions for combatting cheating.[18]

1. Ideally, homework should be unique to each student each semester or not graded at all. This does not mean that homework should not be required. A check indicating that the homework has been completed will suffice. Under this system students no longer have anything to gain by copying one another's work.

2. Test and quiz integrity must be maintained. This means that problems must be changed from section to section and year to year in ways other than merely changing numerical solutions. Whenever the tests are duplicated for distribution, security must be maintained. One might also consider distributing copies of old tests and quizzes. This diminishes the advantage some students might otherwise have as well as provide all students with an additional study guide.

3. Allowing crib sheets or open book tests is encouraged. Students are all afforded the same advantage and the instructor can construct the test accordingly. If students are not allowed to use crib notes, then they should not be allowed to use their own scratch paper. The instructor should distribute answer sheets prior to the test. Test

booklets should also be avoided unless they are collected at the beginning of the hour, inspected for marks, coded to avoid switching during the test, and distributed immediately prior to the test.

4. Calculators must have their memories erased before the test. The new caluculators give the student who can afford them up to 2K memory capability. This, combined with programmable dot matrix symbols, offers students the ability to program unlearned equations, derivations, and constants into the calculator. The best way to eliminate the calculator advantage is for the department to purchase enough of the same calculators for each examinee.

5. Cheating must be discussed in the classroom. What constitutes cheating and subsequent penalties must be explained during the first class meeting. This information should appear in the syllabus as well. It must be made clear that cheating, for whatever reason, is wrong. This also provides an opportunity to teach professional ethics by discussing the similarity of the engineering community's professional code of ethics to the code of academic ethics operative in the classroom.

6. Policy enforcement is imperative. Every time a student is caught cheating, appropriate action must be taken against the offender. Enforcement increases the probability of students learning that they will be held accountable for unethical behavior.

7. As much as possible, but without violating a student's rights to confidentiality, the manner and results of adjudication should be made public.[19] Doing this will increase awareness of the consequences one faces when behaving unethically. One way of publicizing this

information would be to place brief descriptions of the proceedings (without identifying the violators) on bulletin boards. Another would be to publish brief descriptions in student publications (e.g., campus newspapers and magazines).

8. Due process must be assured. An incorrectly adjudicated cheating violation can have negative consequences for all involved parties. Most universities and colleges have Offices of Student Affairs which not only aid instructors in assuring due process but also maintain records of student conduct. All incidents must be reported to this agency. If cheating were not reported to a central record-keeping agency, then repeat offenders might never be discovered.

In conclusion, academic dishonesty harms not only the cheaters themselves, but also other students, professors, the university, the engineering profession, and society in general. Certainly we do not have all the solutions to this problem, but perhaps we have some of them, and their implementation may better serve the needs of us all. Further, we urge our colleagues to consider what further steps might be taken to resolve this problem and share that information through additional public discussion and debate.

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